

Responsive to the Office communication dated May 6, 2002, applicant responds as follows.

REMARKS

Applicant, through his attorney, wishes to thank the Examiner for the indication of allowance of claims 1 - 8.

The following information is submitted to respectfully help convince the Examiner that all 14 claims of the original application are allowable, including claims 9 through 14.

The Examiner rejects claims 9 and 11 - 14 specifically citing U.S. Patent 5,861,695 to Sugati et al. and U.S. Patent 6,114,789 to Pengov et al. and references the text: "Electromechanics and Electric Machines" by S.A. Nasar and L.E. Unnemehr, page 7. It is respectfully urged that these references do not relate to the subject invention, for reasons to be explained as follows and, therefore, all of the claims 1 through 14 should be granted.

All AC induction motors operate on the principle of a "rotating DC magnetic field" that moves across a conducting surface, i.e. squirrel cage rotor. The DC magnetic field is created within the motor by stator windings that are mechanically displaced from each other by a specific angular amount. Each winding is excited by AC power sources that are phase displaced in time from

each other, hence, creating a DC rotating field vector. In its most simple form, for example a two pole machine, there are two field windings that are mechanically displaced by 90 degrees. Each field winding receives sinusoidal AC electrical power which is phase displaced in time by 90 degrees. The resulting field vector that is created within the motor is actually a DC field that rotates around the rotor cavity at a rate exactly and precisely determined by the frequency of the AC source. This DC field moving relative to the conductive rotor will create eddy currents within the rotor which in turn produces a force (torque) on the rotor to, in effect, drag the rotor in the direction of the moving DC field. If the stator field were replaced by a DC permanent magnet and mechanically driven at the same rotational velocity, then the effect on the rotor would be identical. This is the basic principle involved in the motor cited in U.S. Patent 5,861,697 to Sugita et al. The Sugita et al. motor obtains its primary power from a single phase source, but it uses a capacitor connected in series with this single phase source and its quadrature winding to create a time phase shifted current that is 90 degrees phase displaced with the main field winding. So although the power source is single phase, the motor elements are constructed to create in effect "two phases". The present invention is completely different

in its method to create torque from an AC power source. As explained in applicant's specification, there is (in a two pole configuration) a single conductive loop placed in the rotor that has each side located in slots that are diametrically opposite. The stator has coils that are mechanically displaced from each other, but each stator coil is energized by the AC power source separately and individually and in sequence depending upon the position of the rotor coil within the motor. There is no time phased AC power. There is no rotating DC field. The internal field is strictly an AC field that is positioned relative to the rotor coil to produce torque in a most unique fashion. Figure 1 (attached) depicts a two pole machine with the rotor containing the shorted conductive loop. The AC stator field flux cannot flow directly through the conductive loop because the AC stator field flux induces a current to flow in the shorted rotor loop, and this induced current produces its own flux which is in direct opposition to the imposing stator field. As a result, the stator field must flow across the air gap and into the rotor in restricted regions designated as region A and region B in the figure. This increases the flux density in those regions and, hence, increases the reluctance. Since the field is excited by a constant voltage AC power source, the total flux must remain constant also. Therefore, the field current

automatically will increase to create the necessary magneto motive force (MMF) to force the flux through the region of greater reluctance. The field energy is defined as the product of the flux ϕ , the number of coil turns N , and the current I . Obviously, when the plane of the rotor loop is in line with the pole axis, no current is induced in the rotor loop and no opposing field is generated. Hence, this is a position of minimum field energy. The motor torque is always developed in the direction to minimize the field energy and that happens to correspond to the place of minimum reluctance as well. Figure 2 shows the torque effect for different positions of the rotor loop. To explain further, consider Figure 2C. If the rotor is held fixed in the position shown, and AC power is applied to the field, a torque will be developed in the clockwise direction. Similarly, in Figure 2B, if the rotor is held in the position shown, the torque will be in the counter-clockwise direction. For the purpose of ease in description, the Figures 1 and 2 depict the stator as being salient pole with one stator winding. However, applicant's specification describes the stator windings as being distributed around the stator in particular angular displacements from each other. With such an arrangement, the effective AC stator pole axis can be moved in angular steps by energizing the stator windings in succession thereby causing the rotor

to reposition itself relative to the new stator pole axis. The same single phase AC power is used to power each winding. The AC power is not time phased. Each angularly displaced stator winding is energized in sequence with the same single phase AC power as shown in Figure 3 of the present patent application.

An alternative method, also described in the present patent application, is a method to create the AC vector and move its position using two stator windings that are displaced by 90 degrees. Single phase and in phase AC power is applied to each winding, and there is no time phase displacement. The internal AC vector is created by controlling the relative amplitude of the AC power in sine and cosine relationship determined by the sine and cosine functions of the desired vector position.

In Pengov et al., the electrical power supplied to the stator windings is DC (direct current), and not AC as in the presently claimed invention.

To summarize, claims 9 and 11 - 14 are directed to a motor in which the field of the stator is AC and such field rotates around the axis of the rotor. Neither Sugita et al. or Pengov et al. have such a function, so a combination of these cannot provide such a condition and, therefore, cannot render the present invention obvious.

With regard to claim 10, the two cited references, U.S. Patent 6,078,161 to Kim et al. and U.S. Patent

5,229,677 to Dade et al. use electronic switches to PWM the power source in order to control the voltage and current amplitudes to the field windings. Note also, that the resulting frequency of the field must be directly related to the rotational speed of the motor. With the present invention, the electronic switches generate a fixed AC frequency and the motor field inductance automatically limits the field current. No PWM is required in the general configuration.

It is firmly believed that the foregoing information and explanation establishes beyond question that the present invention is truly unique and original to the state of the art; that it is not obvious, and that it is an important and useful invention. It is respectfully requested that all 14 claims be allowed so that this important invention can be protected.

If there are any further fees required by this amendment not covered by the enclosed check, or if no check is enclosed, please charge the same to Deposit Account No. 16-0820, Order No. 28870.

Respectfully submitted,

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